

# Modern Concepts of Cardiovascular Disease

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## THE HEART IN RELATION TO GENERAL ANESTHESIA AND SURGICAL OPERATION \*

There is apparently a widespread belief, among both physicians and laymen, that anesthesia and surgical operation impose a serious load upon the heart and circulation; it is very often indeed that surgeons ask their medical colleagues to determine if the heart "will stand the strain of an operation," and there can be little question that many necessary operations have been postponed or refused because of fear that the heart might be seriously embarrassed by the procedure. There is no convincing evidence supporting such a belief, and a great deal indicating that it is erroneous. It is presumably based upon the fact that it is not unusual for even normal individuals when anesthetized to display considerable cyanosis, rapid respirations, elevation of heart rate, and wide departures of the blood pressure from its normal level; in a small percentage of cases, transient irregularities of the cardiac rhythm may appear. While all of these may be, and often are, due to or associated with cardiac insufficiency, it is not correct to interpret them so in the case of a patient under anesthesia. The rate of the respirations and the presence or absence of cyanosis are determined in large measure by the proportion of oxygen and of carbon dioxide received by the patient. Elevation of the heart rate and of the blood pressure depends very largely upon the competency of the anesthetist, far less upon the anesthetic, although it is true that moderate rises occur with ether, and often with nitrous oxide, even when the anesthetist is highly skillful and experienced. It is likewise true that such changes in heart rate and blood pressure are comparable in all respects with those resulting from the usual activities of normal life, and cannot be regarded as imposing any serious burden upon the heart. Profound falls in the blood pressure, unless due to profuse hemorrhage, are usually associated with "surgical shock," which has little or no relation to the condition of the heart. The important fact to keep clearly in mind is this: that it is perfectly possible

to subject a patient to anesthesia and operation for a period of several or many hours without any change in the normal mechanism of the heart, without cyanosis or venous engorgement, and without significant change in the heart rate or the blood pressure. In the face of this knowledge, it becomes impossible to assert that any important burden is imposed upon the heart by the procedures under discussion. It should not be forgotten that the occurrence and degree of cyanosis, muscular rigidity, tachycardia, and elevation of blood pressure depend almost entirely upon the competency of the anesthetist.

It is, therefore, the present view of most experienced observers that anesthesia and operation do not, of themselves, result in any considerable increase in the work of the normal heart. What of the heart that is diseased? If one keeps in mind the clear distinction between heart disease and heart failure, it may be said dogmatically that a heart which is damaged but which is capable of meeting the ordinary demands of daily life is the equivalent of a normal one for purposes of anesthesia and operation. In determining fitness for operation, therefore, a history of the patient's activities and symptoms is far more valuable than is physical examination, so far as the heart and circulation are concerned; if the individual is able to indulge in moderate activity without symptoms, no concern need be felt about the ability of the heart to sustain the very slight extra work entailed by a surgical operation, provided the anesthetic is properly administered. To this statement there is an important exception. There are several manifestations of heart disease that are notoriously apt to lead to sudden death, even with the patient at rest and apparently in fair health: syphilitic aortic insufficiency, complete heart block, aortic stenosis, and that form of heart failure known as angina pectoris. It is clear that patients with heart block or with angina will seldom be able to lead normal lives without symptoms; the only important exceptions to the statement made above, therefore, are syphilitic heart disease and aortic stenosis.

If there is early heart failure of the congestive type, attempts should be made to improve the state

\* Chloroform, spinal and local anesthetics are purposely not included in the following brief discussion, which is concerned chiefly with ether, nitrous oxide and ethylene.

of the circulation by means of rest and digitalis before operation is performed. The presence of rales at the bases of the lungs is perhaps the best indication that such a procedure should be instituted. If auricular fibrillation or auricular flutter is present and the ventricular rate is rapid, it is advisable to reduce this to normal by full doses of digitalis prior to operation if there is time, but in the absence of heart failure even this may be postponed, and a large dose of the drug given immediately before or (by intramuscular injection) during the operation. If advanced heart failure is present, as indicated by dyspnea at rest, orthopnea, congestion of lungs and liver, ascites, and edema, surgical operation would naturally be considered only if extremely urgent, and the urgency of the surgical condition must always dictate the decision. It is important to point out, however, that if operation can be postponed, a period of rest and medical treatment often results in such improvement that the surgical procedure may be performed later with safety.

There is at present no acceptable evidence indicating that any useful purpose is served by the routine preoperative administration of digitalis to patients who do not have heart failure or auricular fibrillation. If the circulation is being normally maintained, it is impossible to improve it, and it has not yet been shown that the percentage of operative and postoperative complications is lowered by routine preoperative digitalization. Nor is there any valid reason for believing that the routine use of this drug following operations upon elderly people has any effect upon the mortality rate or rapidity of convalescence; in such individuals the drug *may* be beneficial, but its value has not been established beyond doubt.

Of the various irregularities of the cardiac rhythm which so often disturb the surgeon, there are but two that need be regarded as serious: high-grade heart block and paroxysmal ventricular tachycardia. The former, unless due to the administration of toxic doses of digitalis, is usually but one manifestation of advanced heart disease, and the decision for or against operation should be made on the basis of the presence or absence of heart failure. The latter arrhythmia is so closely allied to coronary arterial disease or closure on the one hand and to ventricular fibrillation (with sudden death) on the other, that one should be hesitant about starting an operation while this mechanism prevails. The presence of premature beats, without evidence of cardiac abnormality, is of no importance whatever except that, if they are very frequent, one should realize that paroxysmal tachycardia may occur during or after the operation. Paroxysmal tachycardia of the usual (auricular) type is seldom a source of anxiety unless it occurs during or immediately following the operation; in these circumstances it is usually more distressing to the surgeon than to the patient. It is not

serious and almost always subsides in a short time without treatment. If it persists it can be stopped by the usual medical measures. The same general statement may be made with regard to auricular fibrillation or auricular flutter occurring during or shortly after operation; they are usually of short duration but if persistent, they may be quickly controlled by means of digitalis, which is rarely necessary. No one of these disturbances, occurring during operation, requires any treatment at the time; despite their rather dramatic manifestations they cannot properly be regarded as cardiac emergencies. Permanent auricular fibrillation, as already indicated, should be treated prior to operation if possible. If the fibrillating heart is under digitalis control, if the ventricular rate is at or near the normal level, and if signs of heart failure are absent, these patients will withstand anesthesia and operation as well as similar patients whose hearts are regular. It is never the presence of the irregularity that is important, but always the state of the circulation, as indicated by the presence or absence of physical signs of venous engorgement.

The usual level of the blood pressure is not of great importance in deciding for or against operation; if already extremely high, it is probably advisable to use avertin or ethylene in order to avoid the usual rise in pressure during the stage of induction. The rule already mentioned applies to hypertension and hypotension as well as to heart disease: if the patient can lead a normal life without symptoms, the heart and circulation will almost certainly stand anesthesia and operation.

The foregoing remarks may be applied without alteration to the state induced by sodium amytal or avertin, provided these agents are given in doses that produce anesthetic sleep rather than full and deep anesthesia. The fall in blood pressure that is commonly noted after the administration of avertin appears to be comparable with that observed during normal sleep; it seldom gives rise to symptoms, is usually slight or moderate in extent, and is almost always prevented or corrected by small doses of ephedrine.

So far as the choice of anesthetics is concerned, but little need be said. In normal patients and in those who have heart disease but no heart failure, it is a matter of indifference which one is selected, since they are equally devoid of harmful influence upon the heart. For the patient with slight or moderate heart failure, ethylene and oxygen would be the usual first choice of the writer, but nitrous oxide or ether, or a combination of them, is often very satisfactory. In any event, it is impossible to over-emphasize the statement that the choice of a competent anesthetist is far more important than the choice of the anesthetic, and the greater the degree of heart failure, the more important this choice becomes.

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